



Custom Fitting the Shotgun



SONORAN DESERT INSTITUTE

SCHOOL OF FIREARMS TECHNOLOGY

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S O N O R A N



**D E S E R T
I N S T I T U T E**



Introduction

Most gunsmiths require very exact dimensions when building a shotgun for an individual. To acquire these dimensions, a gunsmith measures the individual's body dimensions, like a tailor measures a customer for a suit. If a person cannot be measured on the premises, a form can be mailed to the customer who can fill in the necessary information (Figure 1). If these measurements are exact, the experienced gunsmith can supply a finished shotgun that fits the shooter precisely. A well-fitting shotgun not only pleases the customer, but also provides good business publicity for the gunsmith.

Why a custom-fitted shotgun? With the large variety of new and used guns available, it seems that a custom fit is not necessary. It is not absolutely necessary for the average hunter or skeet/trap shooter to have a custom-fitted shotgun. However, there are competitive shooters who make a living with their guns, just like professional athletes make a living from their athletic talent and abilities. In competition, one miss could mean the difference between winning a \$25,000 or \$50,000 prize. Professional shooters want their guns fitted exactly to achieve the highest performance possible when in competition.

There are some shooters who need modified firearms due to a physical handicap. For example, a right-handed shooter with a dysfunctional right eye has special needs. The gun must be modified so the shooter can shoot left-handed using the left eye or shoot right-handed using the left eye.

There are also individuals who prefer to purchase custom-made guns. They might collect and display firearms as a hobby. A fine custom-made gun is prized in any collection.

There are no hard rules for fitting a shotgun to the shooter. Since each individual is different in stature and/or shooting style, proper measurements will vary for each person. In many cases, a slight modification of one or more of the following factors helps improve the shooter's ability:

- Trigger pull
- Pitch
- Drop at comb and heel
- Cast-off and cast-on

With so many different reasons why people want to have a custom-made gun, there is a large demand for gunsmiths who can provide this service. As a result, custom fitting shotguns is a lucrative branch of gunsmithing.

| CUSTOM GUNSTOCK ORDER FORM | | | |
|---|--|--|--|
| GENERAL INFORMATION | | | |
| Company/Name _____ | | Contact _____ | |
| Phone _____ Fax _____ | | Email _____ | |
| Ship To _____ | | Mail To _____ | |
| City _____ State _____ Zip _____ | | City _____ State _____ Zip _____ | |
| Country _____ | | Country _____ | |
| Ordered in the last 2 years? <input type="radio"/> Yes <input type="radio"/> No | | <input type="radio"/> Retail <input type="radio"/> Dealer <input type="radio"/> Law Enforcement/Military <small>(Dealer and Law Enforcement/Military sales must have established accounts with McMillan. Contact McMillan for information.)</small> | |
| <small>Every stock is custom made. Please fill out as much information as possible that pertains to your rifle and be sure the accessories you choose are available on the style of stock you are ordering.</small> | | | |
| Date: _____ | | Quantity: _____ P.O.#: _____ | |
| STOCK INFORMATION | | OPTIONS | |
| Stock _____ <input type="radio"/> Flat Top <input type="radio"/> Basic Inlet <input type="radio"/> Full Inlet <input type="radio"/> Custom Drop-In info Fill <input type="radio"/> EDGE® Tech <input type="radio"/> Standard <input type="radio"/> Magnum <input type="radio"/> Sniper info Hand Bolt <input type="radio"/> Right <input type="radio"/> Left <input type="radio"/> No Bolt Port <input type="radio"/> Right <input type="radio"/> Left <input type="radio"/> No Port Action/Manufacturer/Model _____ Diameter _____ | | Painted <input type="radio"/> Black <input type="radio"/> Brown <input type="radio"/> Gray <input type="radio"/> Olive <input type="radio"/> Dk. Earth <input type="radio"/> Tan info <input type="radio"/> 2-Color Speckletone Granite <input type="radio"/> 3-Color Speckletone <small>(specify colors below) (specify colors below)</small> Molded-In <input type="radio"/> Marble <small>(specify colors below)</small> <input type="radio"/> Camo <small>(specify colors below)</small> <input type="radio"/> Bondo <small>(no color)</small> Colors _____ Pad <input type="radio"/> ½" Decelerator <input type="radio"/> 1" Decelerator <input type="radio"/> Limbsaver <input type="radio"/> Spacer System <input type="radio"/> 2-Way Vert <input type="radio"/> 3 Way L.O.P. (length of pull) <input type="radio"/> 13.5" <input type="radio"/> Custom L.O.P. _____ <input type="radio"/> No Pad | |

Figure 1: Sample of custom gunstock order form.

Custom Fitting the Shotgun Stock

Custom fitting a shotgun can involve several different tasks. The work may consist of merely reworking the existing stock, smoothing the action, or adding elaborate wood checkering and carving. But the work may also be more complex, requiring a complete overhaul of the entire shotgun, including both stock and metal work. In other words, a custom-fitted shotgun could cost from only a few dollars to \$10,000, depending upon the amount of work involved.

LENGTH OF PULL

One of the most important areas to consider when custom fitting a shotgun to a customer is the length of pull. There are several easy ways to correct this problem.

The best way to get an exact fit is to use a shotgun equipped with a try stock. With a try stock, the recoil pad or buttplate can be adjusted and actually tried on the range until an exact fit is obtained. A stock can then be custom built to these dimensions, or a recoil pad of the proper thickness can be installed. However, unless the gunsmith has considerable stock work, it is hard to justify the cost of a try stock. An alternative to a try stock is to use a pull-and-drop gauge to approximate the distance the stock should be lengthened.

Another way to get an exact fit is to keep building the recoil pad with temporary pads until the correct length is found. When the shooter obtains the right sight picture and begins to hit consistently, then this will be the distance the buttstock should be lengthened. Some shooters do not like a thick recoil pad on their shotgun. If you have a customer that requests a thin recoil pad and the stock needs to be lengthened $\frac{3}{4}$ in. or more, a new stock is the only answer. On the other hand, if the shooter does not mind a thick recoil pad, pads are available on the market with varying thicknesses so you can easily get an exact fit.

One good way of testing the fit of a shooter to a gun is to pattern the shots on a target 30–35 yards away. Using large sheets of white paper, mark a black square or circle about 4 in. across in the center of each target. Have the customer aim directly at the center of the black mark. If the shot pattern is high, as shown in Figure 2, the buttstock is too short. If the shot pattern is low, as in Figure 3, the stock is probably too long.

When the shot pattern centers around the target, as in Figure 4, the stock is the correct fit and size.

A common off-the-shelf shotgun would fit the average size male shooter (5 ft. 9 in. – 6 ft. in height). However, taller shooters with longer arms will tend to place their cheek forward on the stock. Consequently, they will see more of the barrel. A tall shooter will be looking down on the barrel rather than looking along the barrel

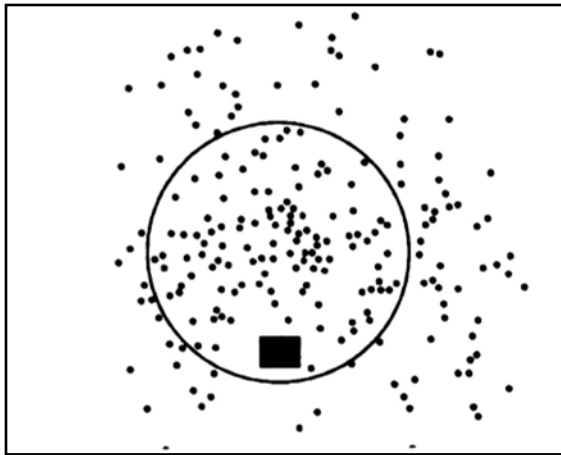


Figure 2: A high shot pattern indicates that the shooter's stock is too short.

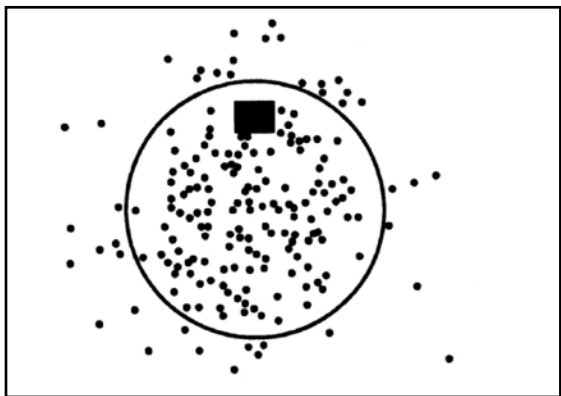


Figure 3: A low shot pattern indicates that the shooter's stock is too long.

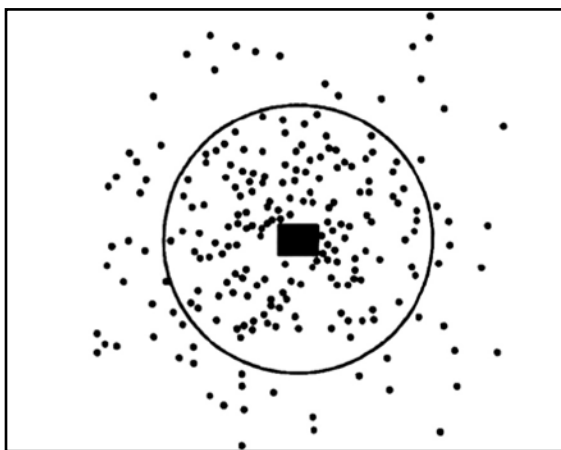


Figure 4: When the shot pattern centers around the target, the stock is properly fitted.

to the front sight, which will invariably cause the shots to be high. A shooter who is shorter in stature with shorter arms will probably hold low on the target if the shotgun stock is too long. As a result, the shots will fall under the target. While your first inclination would be to give the shorter individual a shorter stock, a long stock is usually better than one that is too short. Both lengths will cause the shooter to aim off target, but the margin of error is less on stocks that are a little too long.

The obvious solution to fixing a shotgun stock that is too long is to cut off the required amount. However, you should be aware that just a very small amount of wood taken off will make a big difference in "feel." You should not take off more than $\frac{1}{4}$ in. at one time, and measure in increments of $\frac{1}{8}$ in. First, use a gauge to mark the area of the wood that must be removed. Be sure to keep the same angles as the original buttplate. Use masking tape on this area to protect the finish that will remain, and also to help prevent the stock from splintering. The pattern or guidelines should be plainly marked on the tape. Use a coping or a band saw to carefully cut off the end of the buttstock, as shown in Figure 5. If you are sure of the dimensions, next use a wood rasp to smooth the area and finish with varying types of sandpaper.

Before removing the tape, reinstall the original buttplate or recoil pad (if the original is being reused). Use the existing screw holes, cutting them to a depth to match the thickness of the wood removed. Once the existing buttplate is secure, note any high spots on the butt that will need dressing to make the buttplate fit precisely. Also, be aware that the original buttplate is going to hang slightly over the sides since removing the wood decreases the size of the stock towards the receiver. With the buttplate in place, take a scratch awl and mark on the bottom of the buttplate using the buttstock as a guide. This will show the amount of material that must be removed from the buttplate to make it fit flush with the buttstock.



Figure 5: To shorten the buttstock, use a coping or band saw to carefully cut it off.

Once again, remove the buttplate from the stock and remove any excess material from around the buttplate. This can be done with either a metal file, wood rasp, or sanding disk, depending upon what material is used in the buttplate. Some experienced gunsmiths are able to get the buttplate to fit precisely with the plate off the stock. However, most will trim the plate down to almost perfect, refit the buttplate on the buttstock, and then do the final finishing with the plate on the stock. This is the reason for leaving the masking tape on the buttstock: to protect the stock's finish. If you should slip and damage the stock's finish, this means a lot of additional work. Therefore, be extremely careful in these final stages of refitting the buttplate or recoil pad.

Shotgun balance is very important to enable shooters to do their best work. A muzzle-heavy shotgun is especially awkward and will contribute to misses. The type of shotguns that usually have problems with balance are the heavy duck guns: 3 in. 12-gauge Magnums with 32 in. barrels. Winchester compensated for the long, heavy barrels by installing a counter-weight lead slug in the buttstock of their famous Model 12 duck gun.

If you work on a shotgun that is unbalanced, there are a few ways to correct the problem. If the shotgun is muzzle-heavy, drill holes into the buttstock behind the buttplate or recoil pad and melt lead into these holes to act as a counter balance for the heavy muzzle. Shortening the barrel is another solution. However, if you shorten the barrel, the entire choke will be removed, requiring a new choke to be installed. Chokes can be installed as discussed in an earlier lesson. A new choke can be cut directly into the muzzle of the barrel.

If the gun is butt-heavy, the wood can be removed from the inside of the buttstock to lighten it. Remove the buttplate and drill a series of $\frac{3}{4}$ in. holes parallel to the stock-bolt hole starting from the rear of the stock. Be careful not to get too close to the edges, which may weaken or split the stock.

Out of the many possibilities for fixing a stock, the final decision will usually depend on what your customer wants. Then, you will be in a position to make further recommendations and also decide if you want to handle the job. The average dimensions for shotgun stocks are shown in Figure 6.

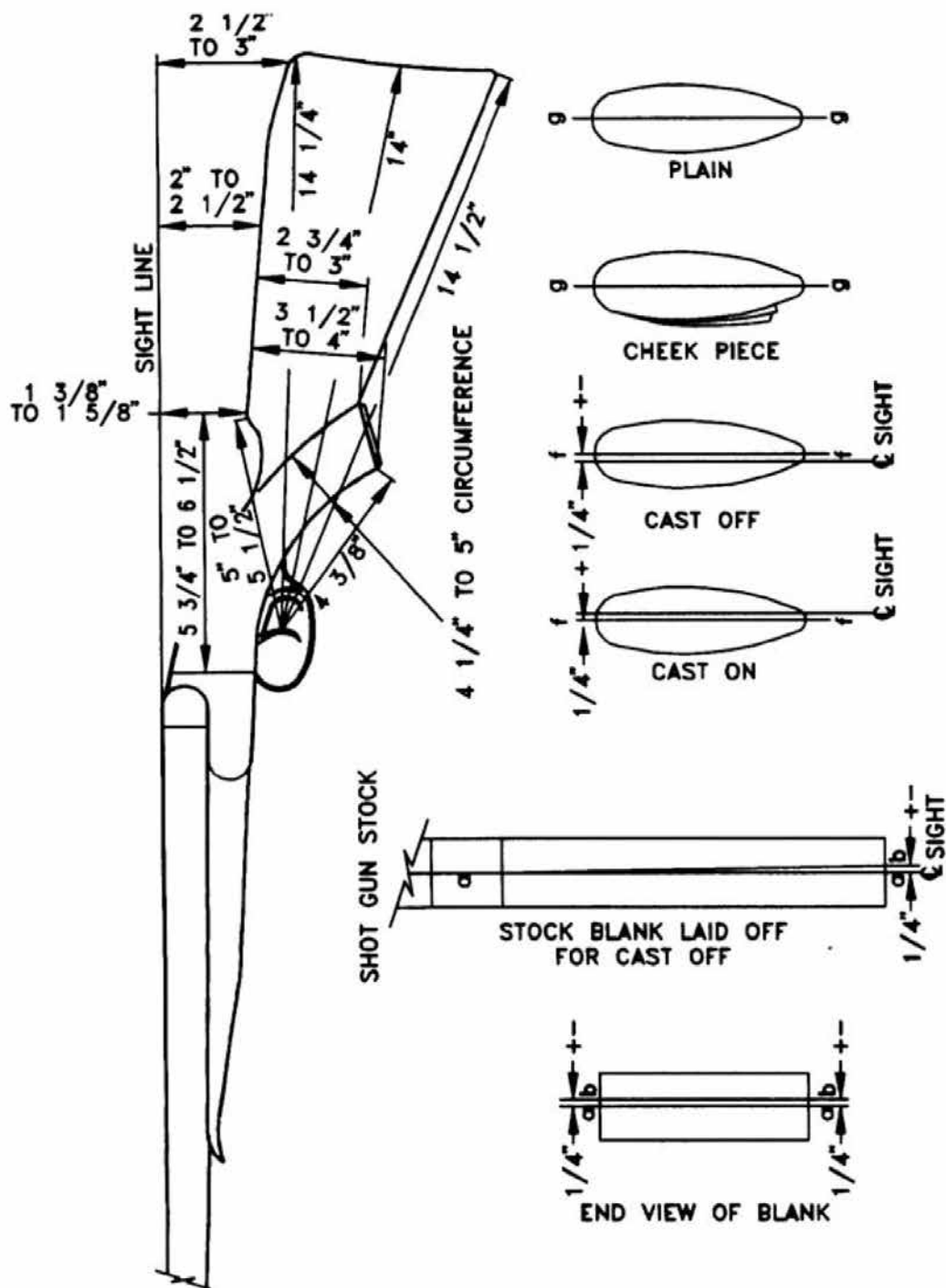


Figure 6: The average dimensions of shotgun stocks.



Figure 7: Example of a TriStar Viper G2 Left-Handed Semi-Automatic Shotguns from AmmoLand.

SPECIALTY STOCKS

As mentioned earlier, some shooters are handicapped and cannot shoot with conventional firearms. To accommodate a right-handed shooter with blindness in the right eye, the traditional solution is to offset or bend the buttstock so that the gun is fired right-handed with the buttplate against the right shoulder and the sighting plain of the barrel aligns with the shooter's left eye (Figures 7 and 8).

Reinhart Fajen, Inc. offers a crossover stock for shooters who must shoot from the right shoulder using the left eye. With this type of stock, the comb of the buttstock is cut down, rounded, and fitted with a cheek rest on top of the stock rather than on the side. When firing, the

shooter holds the butt firmly against the shoulder with the head tilted across the stock so the left eye lines up with the sights. The forward part of the comb must be cut down and must move freely so the recoil will not jolt the comb into the shooter's face.

Another way to supply a crossover stock is to use a piece of flat steel with two ivory bead sights attached that runs from the muzzle of the shotgun to the back about 20 in. This "rib" is fastened to the left side of the barrels by two brackets—one at the muzzle and the other about 18 in. back. The sights on this rib are set at over 2½ in. at the rear and 2½ in. at the muzzle. A detailed drawing of the apparatus is shown in



Figure 8: This is an example of a crossover stock, which allows for an extreme cast-off design for use with right-handed shooters.

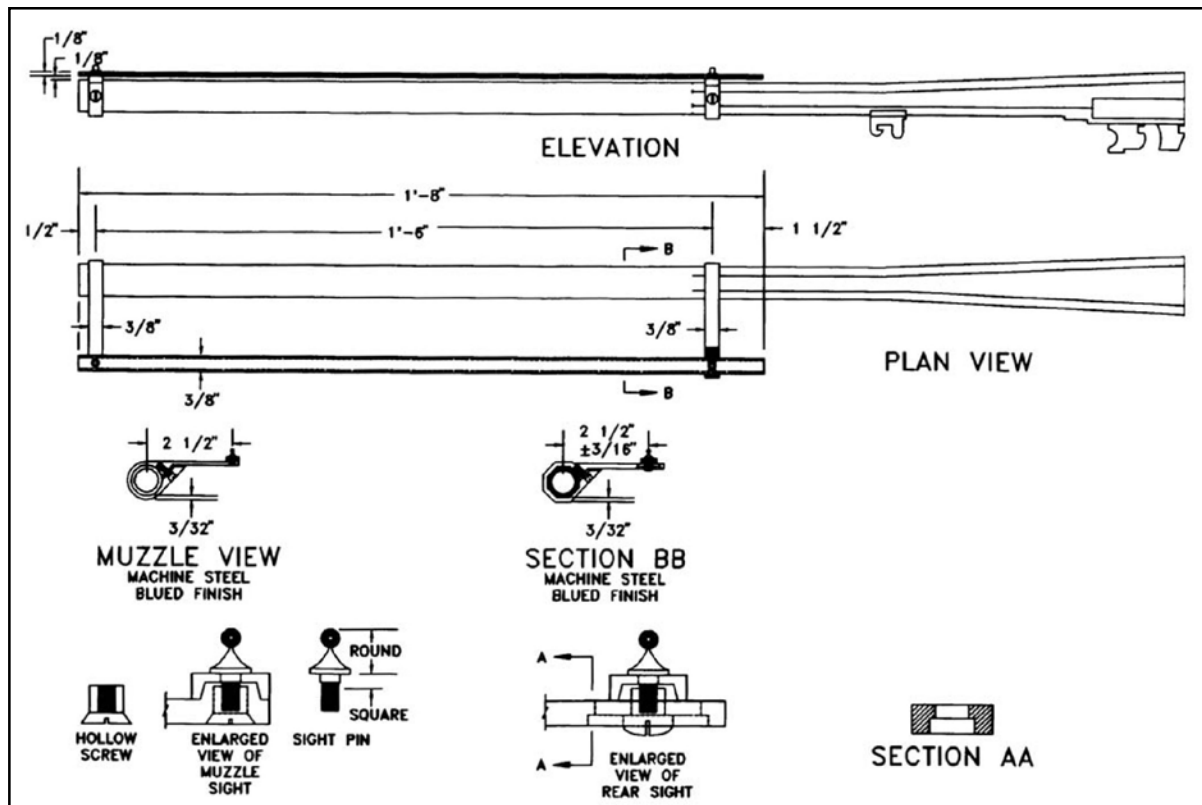


Figure 9: Offset rib used on shotgun barrel for monocular vision.

Figure 9. This is probably the less expensive way of adjusting a gun for a right-handed shooter who must use his or her left eye.

Shotgun Conversions

Several models of 16-gauge shotguns manufactured during the first half of this century were chambered for 2 in. shells, as opposed to the 2¾ in. chambers used for modern 16-gauge shotshells. Single-shot and double-barrel shotguns are easily converted to the longer shells by using the Walker long forcing cone reamer as discussed earlier in this course. However, repeating shotguns, such as the Winchester Model 12 slide-action shotgun and the Browning Auto-5 semi-automatic shotgun (Figure 10), will require additional work on the action to properly feed the longer shells. The following instructions outline the method of converting short chambers in the Browning Auto-5 shotgun to permit use of standard 2¾ in. 16-gauge shotshells. However, the method will also suffice for other models, with a few modifications.

Disassembly. To disassemble, use the enlarged view in Figure 11, on the next page, as a reference. Completely disassemble the gun, removing all drift pins, screws, and parts. This is essential in most altering jobs in order to determine if there are any worn or broken parts that might be in the gun.

Remove the buttstock by first removing the tang screw (B83) held in place by a lock screw (B53). These screws are located on the underside of the stock to the rear of the grip. There is another screw (B66) between these two screws and the trigger guard. Do not remove this screw since it holds the mainspring in place. After removing the tang screw, the buttstock can be removed. Secure the shotgun in a carefully padded vise with the buttstock free. Grip the underside of the buttstock with the left hand and use the palm of your right hand to strike the comb of the buttstock lightly, which will move it rearward. This should loosen the buttstock from the receiver tangs so it may be removed without damage. Remove the trigger plate screws (B87 and B88) and lift out the trigger plate (B86).

Next, remove the carrier spring (B24) by forcing it from under the pin at the front and then sliding it off the one at the rear. Then, remove the carrier (B13) by taking out the carrier screws (B23) and lock screws (B53) from the right and left side of the receiver. When replacing the carrier screws, be sure to put them back in the same side from which they were removed. You will be able to identify the one on the right side because it is marked on the point.



Figure 10: The Browning A-5 semi-automatic shotgun. Those made in 16-gauge prior to World War II had short chambers, requiring a minor alteration for the guns to fire modern 16-gauge shotshells.

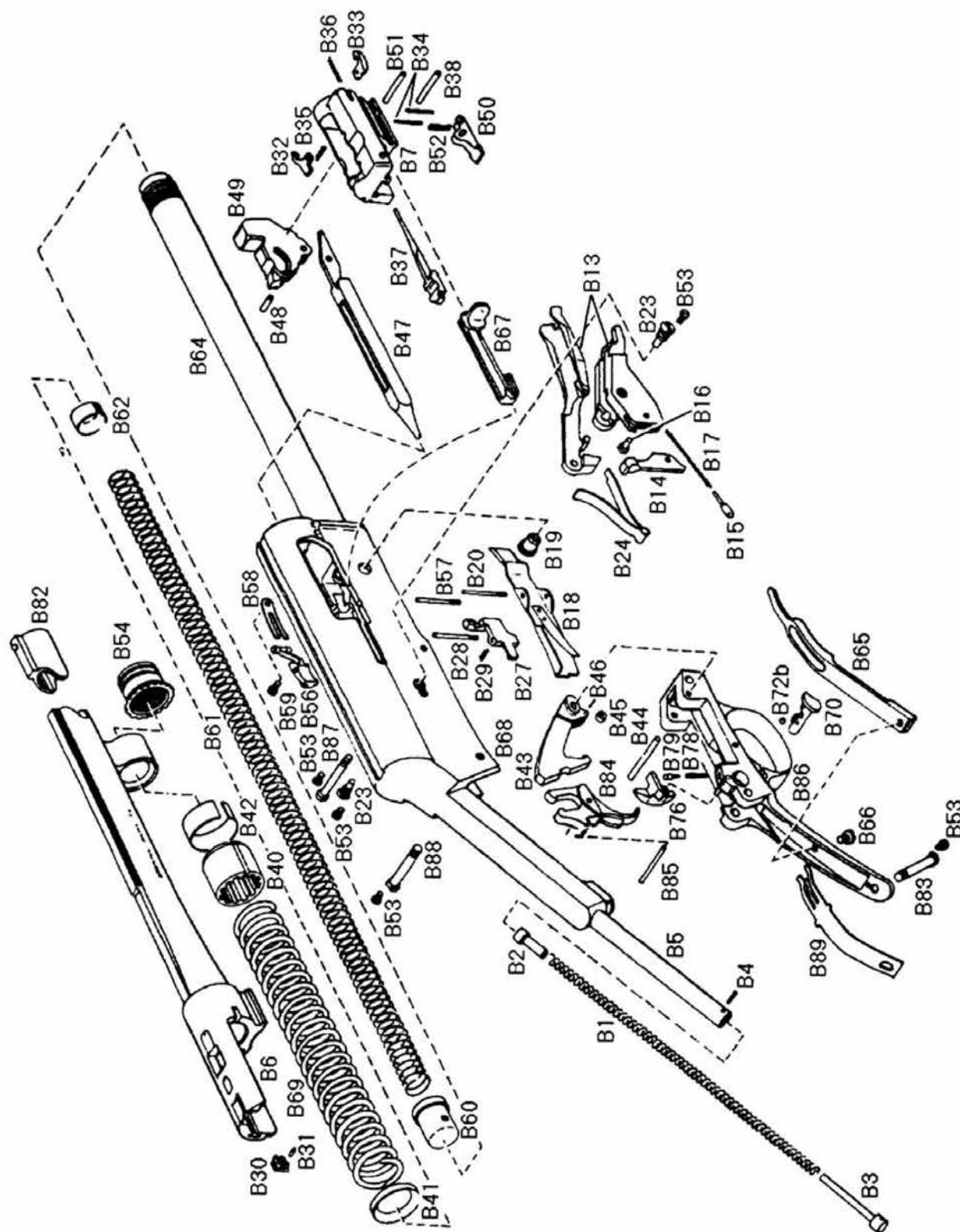


Figure 11: An exploded view of a Browning A-5 semi-automatic shotgun. This will help you during disassembly and assembly.

Draw the breech bolt (B7) back with the operating slide (B67) so that the action spring is compressed. This spring may be held back by inserting a small nail or drift punch in the tang screw hole so that it will not force the breech bolt closed again. Continue by drawing the breech bolt back until the locking block latch pin (B34), which is the first pin at the front of the breech bolt, lines up with the small hole on the left side. The locking block latch pin can then be driven out and the locking block latch and spring (B50 and B52) removed. Lift the rear end of the link (B47)—the long piece of metal cut out in the center and extending to the rear of the receiver—up as far as it will go. Then move the operating slide backward while simultaneously pushing the breech bolt forward and out of the receiver. Reassemble it in the reverse order.

NOTE: When replacing the trigger plate, pull the operating slide back a little or you will be unable to get it in place. This is one of the most important things you should remember about reassembling the Browning Auto-5 semi-automatic shotgun.

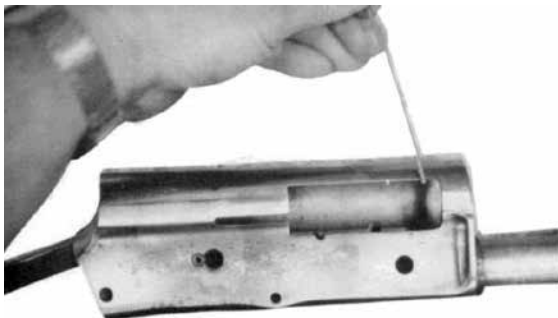


Figure 12: The shell port of the receiver must be lengthened to the forward part of the gun. The distance from the front of the port to the front of the receiver is $1\frac{7}{32}$ in.

Clean. Clean all parts, assemblies, receivers and barrels thoroughly.

Check All Parts. All parts should be carefully checked for wear, cracks, and deformities. These parts must be in perfect condition for the altered shotgun to function properly. Any part that has a defect or is worn should be replaced with a new or replacement part.

ALTER ASSEMBLIES OF THE GUN RECEIVER

The shell port of the receiver, shown in Figure 12, must be lengthened to the forward part of the gun. The distance between the front of the port to the front of the receiver is $1\frac{7}{32}$ in. Three types of tools can be used to perform this job. A hand file or a moto-tool grinder can be used to lengthen the port. If you have the facilities and enough of this type of work, a jig can be set up on the milling machine with a $\frac{3}{8}$ in. end mill as a cutter to remove the metal necessary to lengthen the port.

Link. The link must be altered to prevent the rear portion of the link from overriding the safety sear. It should be milled or filed $\frac{3}{32}$ in. to



Figure 13: The link must be altered to prevent the rear portion of the link from overriding the safety gear. It should be filed $\frac{3}{32}$ in. from the rear, maintaining the same angle.

the rear, maintaining the same angle (Figure 13). Tools required for this operation would be an extra narrow pillar file or a staggered tooth side mill. The size of mill required is $\frac{3}{16}$ in. x 3 in.

Carrier. To accept the longer shell from the magazine, the carrier must be altered at the shell stop portion by grinding $\frac{1}{16}$ in. rearward. This is shown in Figure 14.

A moto-tool grinder with a soft stone about $\frac{7}{8}$ in. x $\frac{1}{4}$ in. is needed. Some of the 16-gauge Browning Automatic parts are carburized, which makes them glass hard. Using a soft stone will make the cutting much easier. For the larger shops, a carbide end mill is designed to fit a special fixture, which can alter the carrier.

Locking Block Latch. The shell stop portion of the locking block latch must be cut toward the rear of the gun. This is done to prevent the shell from overriding the locking block latch when loading shells into the magazine and from lodging between the carrier and the breech bolt. The recommended amount of metal to be removed is $\frac{3}{32}$ in. as shown in Figure 15. A bastard file is used to rough the initial cut and a mill file is used to finish.

Ejector. The ejector must be altered to a movable sliding ejector that slides free, but must not have excessive play. File an oval hole where the ejector rivet goes through this part. The hole is $\frac{1}{4}$ in. long, taking up the complete area between the two rails of the ejector to maintain a web in the front portion of the ejector $\frac{5}{64}$ in. (Figure 16). Use a drill to fit between the rails of the ejector and a round bastard file to enlarge and lengthen the hole.

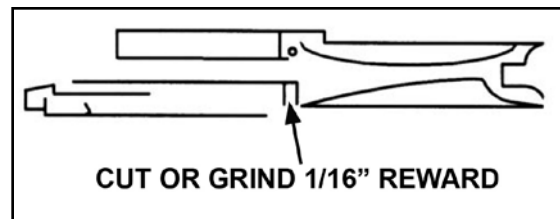


Figure 14: The carrier must be altered at the shell stop portion.



Figure 15: The shell stop portion of the locking-block latch must be cut to the rear as shown.

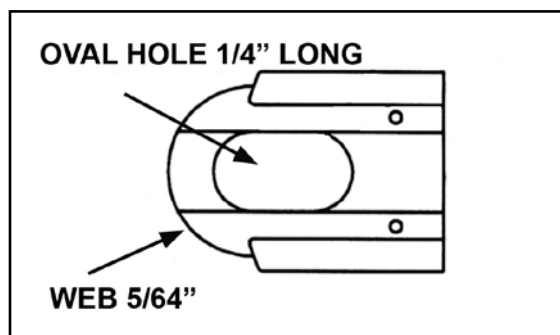


Figure 16: The fixed ejector must be altered to a moving sliding type that should slide free, but without excessive play.

Barrel. The barrel extension is one of the items of the 16-gauge Browning Automatic that is carburized. You need to use a moto-tool 1 in. x ¼ in. soft stone. The barrel and barrel extension must be ground to clear the front end of the longer shell. The line of the outside edge of the barrel extension should be maintained, as well as the inside lower rim of the headspace of the barrel. The barrel and the barrel extension should be ground on an angle from the lowest point of the headspacing to the outer edge of the barrel extension. This is only done at the point from where the extracted shell is ejected (Figure 17). The barrel chamber must be rebored (reamed) to accept the 2¾ in. shell.

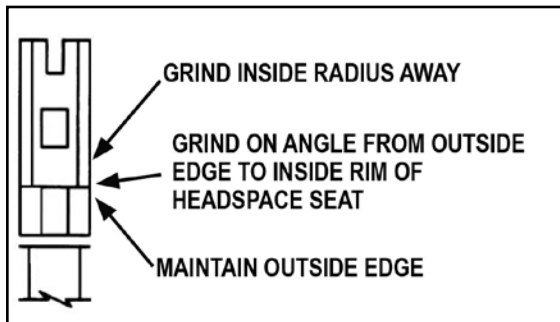


Figure 17: The barrel and barrel extension must be ground to clear the front end of the longer shell.

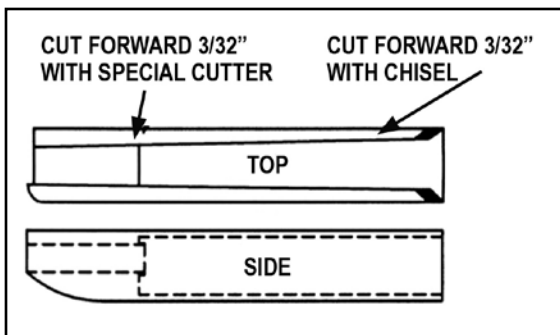


Figure 18: The forend must be altered to let the barrel forward in the receiver.

Forend. The forend must be altered to let the barrel slide forward in the receiver. This is done by cutting on the inside of the forend where the barrel guide ring strikes the forend. The amount of wood removed will be ⅜ in. Wood will have to be removed from the rear portion of the forend to allow the barrel extension and the barrel-extension guide to come into the forend. Where the barrel-extension portion fits into the forend, a woodcarving chisel may be used to remove necessary wood, as shown in Figure 18.

Reassembling Component Parts Into Assemblies, and Adjusting. At this point, the gun is clean and ready for assembly. Replace the cartridge stop and spring, the carrier latch and carrier latch button, and the magazine cut-off and spring—in that order. Reassemble the magazine, magazine spring follower, spring, and magazine spring retainer. This completes the receiver assembly.

Reassemble the trigger guard. Replace in the following order: the safety, the trigger, the trigger spring, the mainspring, the hammer safety sear, and the safety sear spring.

Make all necessary checks, and adjust the safety, the amount of play between trigger and safety sear, and the trigger pull, which should be approximately 5 lbs.

The breech bolt assembly is next. Assemble the component parts in the following order: fasten the link to the locking block; inspect the rim on the locking block rim for cracks or burrs; and inspect the link to see if it is bent. Install this assembly in the breech bolt. Replace the firing pin and the firing pin retaining pin. Check the sharpness of the right-hand extractor and the tension of both extractor springs. Install these in the breech bolt assembly.

For the barrel assembly, install the ejector and ejector stop rivet in the barrel extension. Make sure that the ejector slides freely.

Reassemble Gun and Test. Reassemble the assemblies and component parts in the receiver. Inspect all assemblies for burrs, and make certain that all movable parts move properly and do not bind around pins or screws. After the action has been assembled and the stock replaced, remove any burrs from the friction ring and the barrel guide ring with a honing stone. Check the tension and length of the recoil spring. Assemble the barrel to the action of the gun and test for proper functioning. Testing should be done with 2¾ in. light loads first. Then test with heavy loads.

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